Why Arc There No Interstellar Comets?

Paul R. Weissman (Jet I'repulsion Laboratory)

The formation and subsequent dynamical evolution of the solar system resulted in a large number of icy planetesimals, i.e., comets, lining ejected to interstellar space. This is an ongoing process: ~ 65% of all long-period comets and about half of all short-period comets are dynamically ejected. If planetary systems around other stars behave similarly, then there should be a substantial flux of interstellar comets. However, no comet on a clearly hyperbolic orbit has ever been observed. Sekanina (1976 Icarus 27, 123) used this fact to set an upper limit on the space density of comets of 4×1012 pc^{-3}. Estimates of the number of comets ejected by the solar system vary, depending in particular on the efficiency with which the planets place comets in the Oort cloud, versus eject them on hyperbolic orbits.] lowever, those past estimates were based on a relatively narrow range of semimajor axes for capture into the Oort cloud. Duncan et al. (1987 Astron. J. 94, 1330) showed that the actual range of possible initial orbits is about three times greater than previously thought, and that most comets arc captured into the inner Oort cloud reservoir where they are not easily perturbed, except by close penetrating stellar passages, or by encounters with GMC's. Using this wider range of possible capture orbits, it will be shown that relatively few comets from the Uranus-Neptune zone can **actually** be ejected, and that even Saturn planetesimals will likely wind up in the Oort cloud, rather than escaping to interstellar space. Only Jupiter has sufficient gravity to perturb a significant number of comets to escape. The result is a far higher ratio of final bound orbits versus ejected ones, leading to a relatively low population of interstellar comets. This work was supported by the NASA Planetary Geology and Geophysics Program.

Abstract submitted for AAS/DDA **meeting** , March **28-291994**

Date submitted: February 2], 1994 Electronic form version 1.5